

Screening White Pine for Blister Rust Resistance in Ontario: History and Status

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Introduction

White pine blister rust has been an issue in forestry in Ontario since its introduction and rapid spread in the early 1900s Haddow (1969). Dr. Carl Heimbürger started the search for blister rust resistant white pine when he moved from the federal government to the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources (OMNR) in 1948. He brought with him records and material from federal collections and testing dating back to 1937. This work, started by forest geneticist Dr. L.P.V. Johnson, was continued by Heimbürger through the 1960s.

One of the major sources of potentially blister rust resistant eastern white pine for Ontario's studies came from Pointe Platon, Quebec. This plantation, on the south side of the St. Lawrence River, about 30 miles west of Quebec City was established in 1908, with about 400 plants imported from a nursery in Germany. Many were severely infected with blister rust soon after planting and, starting in 1921, pathologists monitored the plantation and found that some trees did not become infected (McCallum 1941). By 1947 only 35 trees remained alive; these were believed to be inherently resistant to the disease and several seed collections were made (Heimbürger 1956).

Connaught Range Test

In 1947-48, a trial was established at Connaught Range, Ontario, using seemingly blister rust resistant white pine collections from Dr. Gast, Harvard Forest, Dr. Riker, Wisconsin, the Petawawa Forest Experiment Station, and Pointe Platon with bulk controls from the Ontario Tree Seed plant in Maple. In this trial, 1400 trees from 48 seedlots were planted with alternating rows of locally collected *Ribes cynosbati*.

The plantation at Connaught Range was assessed periodically for blister rust, and trees were removed as they became infected. By 1984, 48 trees remained alive; 27 of these came from the Pointe Platon collections. Seeds and scions were collected over the years and used in the testing and breeding program at Maple as well as in various field trials.

Maple Research Station Tests

Heimbürger worked on the white pine genetics projects for OMNR at Maple from 1948 to 1968, followed by Louis Zsuffa from 1968 to 1984. During this period, a program of acquiring exotic soft pine, breeding, hybridization, nursery bed testing and field trial testing continued (Zsuffa 1979). They collected samples from 17 species of soft pine, made about 1300 crosses, of which 800 produced seed, and produced about 100 hybrids.

Heimbürger (1956) described the following technique for white pine blister rust resistance testing in nursery beds:

"The seedbed is surrounded by a frame of lumber, the soil is moistened, and *ribes* leaves are planted in the soil rather densely among the seedlings, with their petioles about ½ inch in the soil, and watered down. The bed is covered with a lath screen and double thickness of wet burlap, which is held down by another lath screen. The whole is kept moist for about a week by watering. "

Their approach was to infect plants for 2 or 3 years, grow them for 3 to 4 years, and then move the survivors into breeding compartments. OMNR records show that about 26,000 grafts from 1500 different clones and 300,000 seedlings from 900 families were tested, with 2438 grafts and 651 seedlings surviving.

Archives

The white pine experimental material from Maple was planted in archives (gene banks) in southern Ontario, and when the provincial research institute moved from Maple to the Sault in 1989, a major grafting program was undertaken to safeguard the Maple stock in other archives. OMNR now has archives across southern Ontario (Figure 1) with about 1500 different selection (both families and clones) representing 17 species and 100 hybrids. As part of the current program, we have collected open-pollinated seed from the archives and will conduct controlled breeding

Field testing

Between 1970 and 1990, blister rust resistant material was used to establish 24 field trials across Ontario. These trials ranged from small, and not well laid out, to large and well laid out. The tests used both pure *strobos*, primarily from the Connaught Range test, and hybrids, primarily *P. griffithii* x *strobos*. The trials were assessed for survival, growth, and incidence of blister rust and weevil in the years following planting.

One of the more successful field trials was established at Rook Farm, near Pembroke, Ontario. Established in 1974, this trial has 9 open-pollinated families from the Connaught Range test as well as bulk controls. There are 4 replications of 20-tree plots. The trial has since been thinned leaving 16-tree plots. Fall 2000 assessments found that survival in the control plots averaged 33%, while survival of the test populations averaged 65% (Figure 2).

Current Program

In 1999, OMNR's provincial genetics program was encouraged to reexamine the white pine blister rust resistance program. We have been able to recover the accession records and field trial data and have received training from Paul Zambino on the disease inoculation methods developed by the US Forest Service. In 2000 and 2002, we collected open-pollinated seed from our archives. Inoculations began with a small test of 25 families during summer 2002, followed by a test of 200 families. This includes both pure *strobos*, some from Connaught Range, and *strobos* hybrids with 10 other species. Our tests use young container seedlings and all seedling production and inoculations occur in the on-site growth facilities at the Ontario Forest Research Institute in Sault Ste. Marie. We are using *Ribes nigrum* var Ben Alder, a commercially available currant variety; raising the *ribes* in greenhouses; inoculating in the lab; and rearing to telia stage in our growth room. Pine inoculation occurs in a tent in our growth room at 18°C, still air, and high humidity. Leaves are placed in racks above the pine, and left until a target of 5000 spores per cm² is reached. Plants are kept in the tent for one week, and then moved to a high humidity greenhouse where they are monitored for disease symptoms. We will be continuing an active program of controlled breeding, cone collection, and further lab inoculations in 2003. We will also plant a small trial using 128 open-pollinated families from the 2000 seed collections at our arboretum in Sault Ste. Marie.

References

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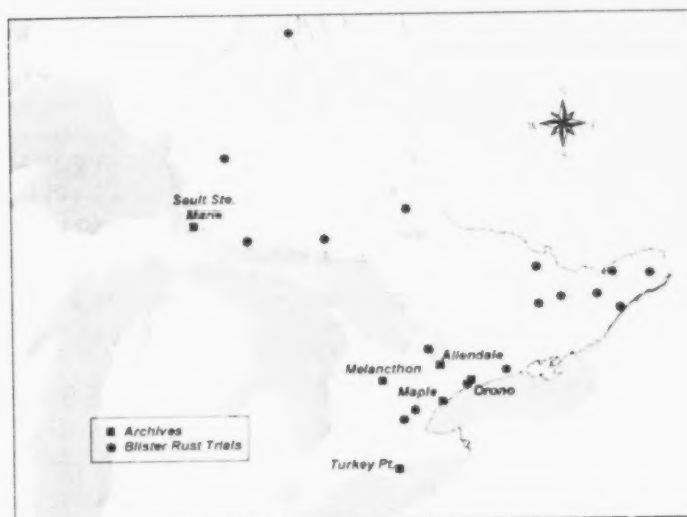


Figure 1. Location of white pine archives and blister rust resistance trials in Ontario.

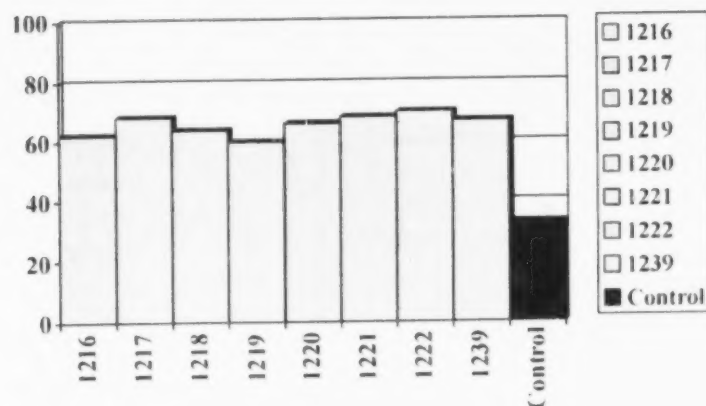


Figure 2. Survival of selected white pine open-pollinated families at the Rook Farm test site 26 years after planting.

